

Flowering Plants - Angiosperms



Flowering Plants - Angiosperms

- Largest group of Land Plants!
- Most important economically!
- Apomorphies:
 1. Flowers
 2. Carpels
 3. Fruits
 4. Double fertilization with triploid endosperm
 5. Specialized conductive cells

Why have Angiosperms been so successful?

1) Flowers

What is a **flower**?

= Shoot system bearing **modified leaves**:

Perianth

Calyx (sepals) - green, protective

Corolla (petals) - colored, attractant

Stamens - male

Carpels - female



modified
leaves

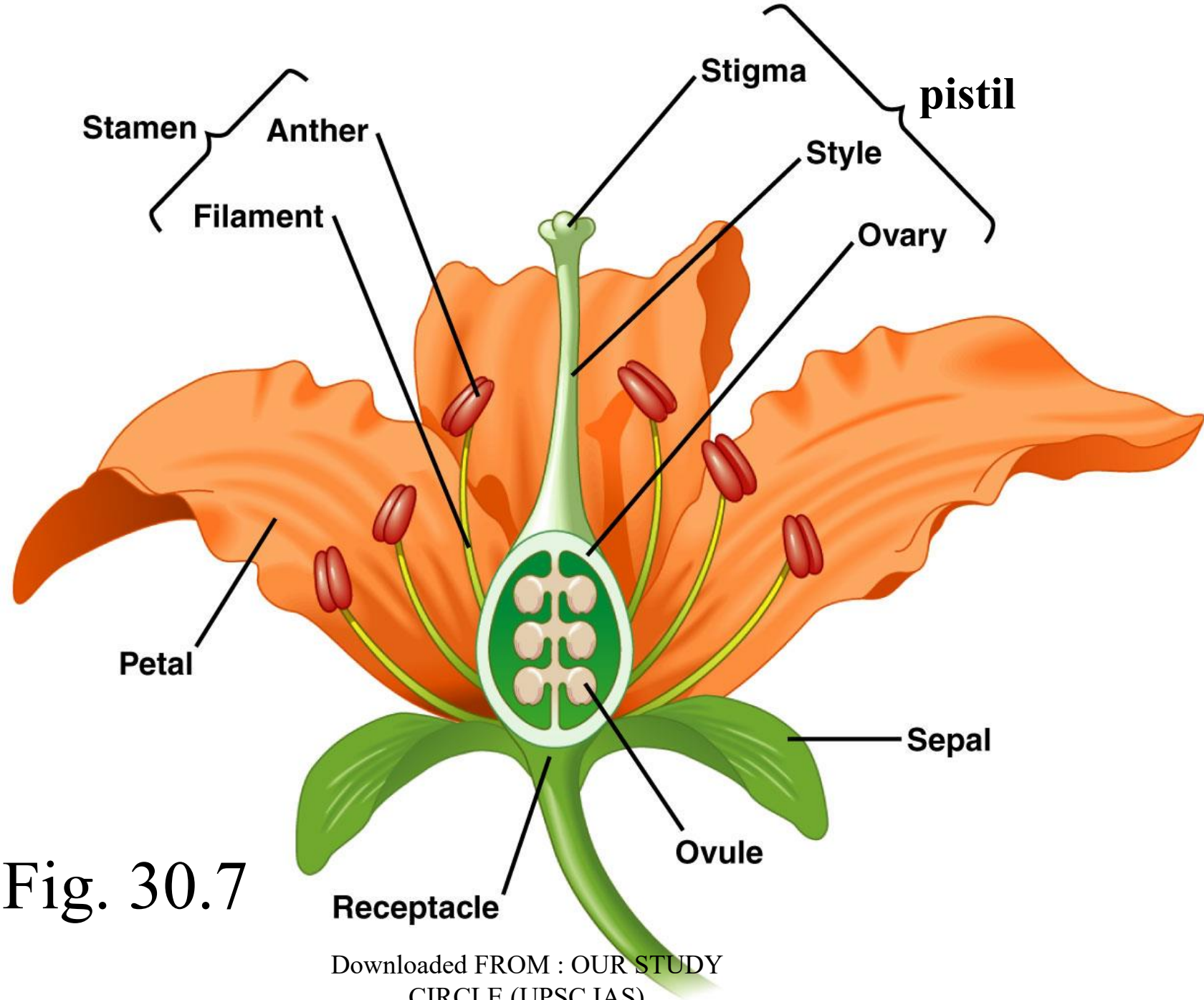
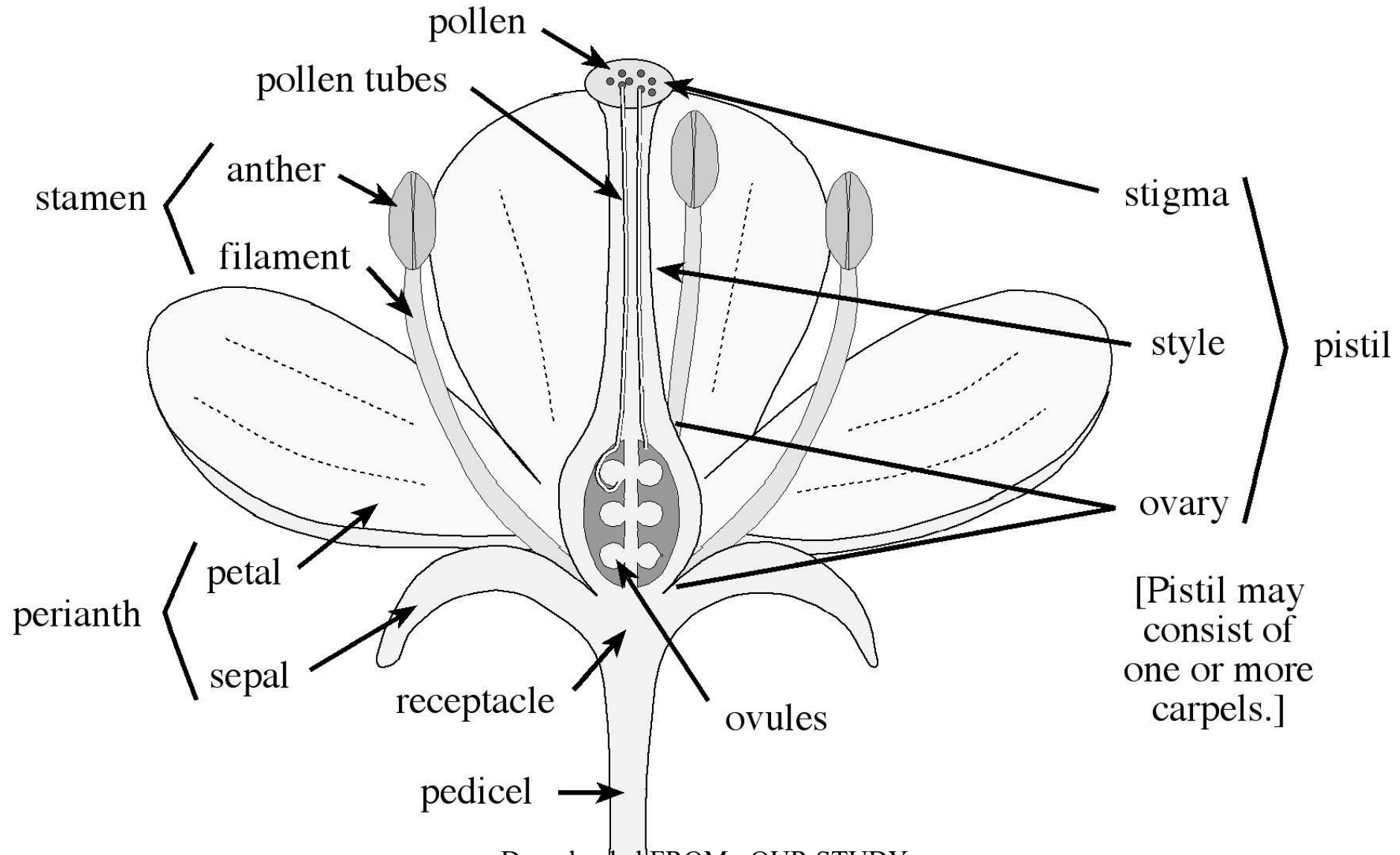


Fig. 30.7

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Flower parts:



Flower pollination (transfer of pollen to ovule):

Animal pollination

Ancestral for Angiosperms

Much more efficient means of transporting pollen

All Gymnosperms are wind pollinated

(Some Angiosperms secondarily wind pollinated)

Strategy of animal pollination:

Attractant

Visual: large or brightly colored perianth

Olfactory (smell): sweet or rotten (fetid) odor

Reward

Usually nectar or pollen

(Rarely waxes, oils)

Pollination Mechanisms

Insects

Bees

Butterflies/Moths

Flies

Birds

Bats

Water

Wind



Bee-pollinated

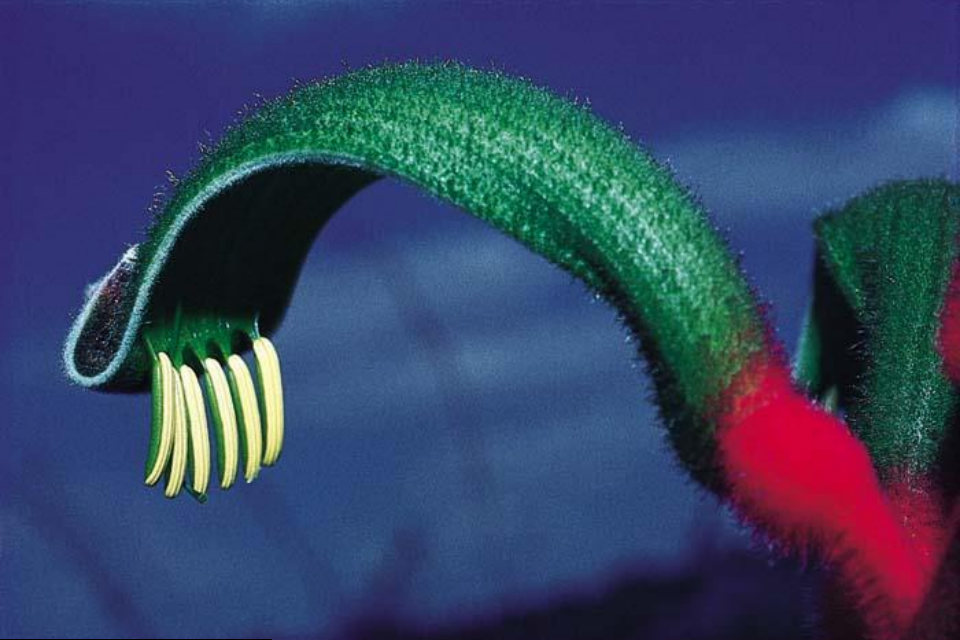
Moth-pollinated





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Fly-pollinated



Bird-pollinated



Bat-pollinated



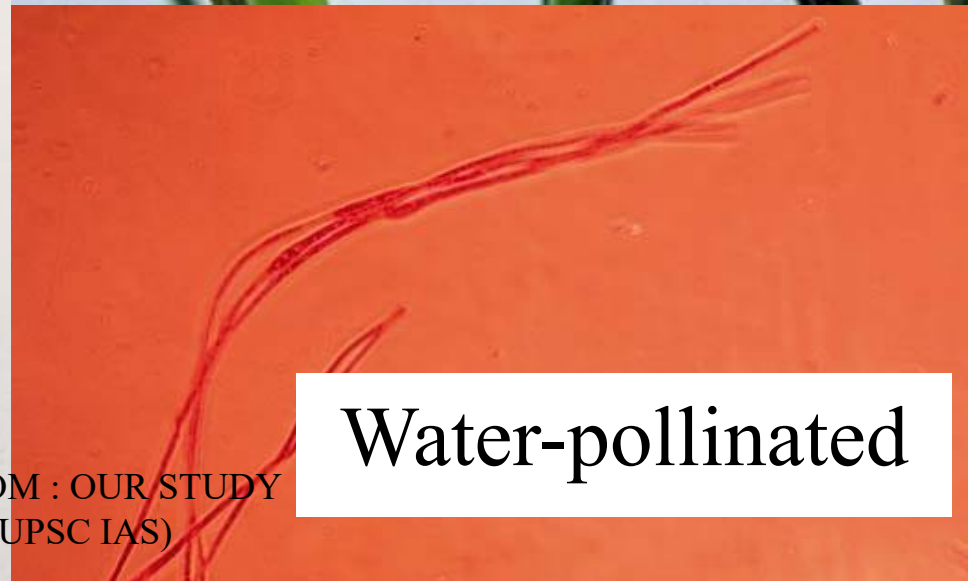
Wind pollination in grasses

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Phyllospadix torreyi

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Surf-Grass CIRCLE (UPSC IAS)



Water-pollinated

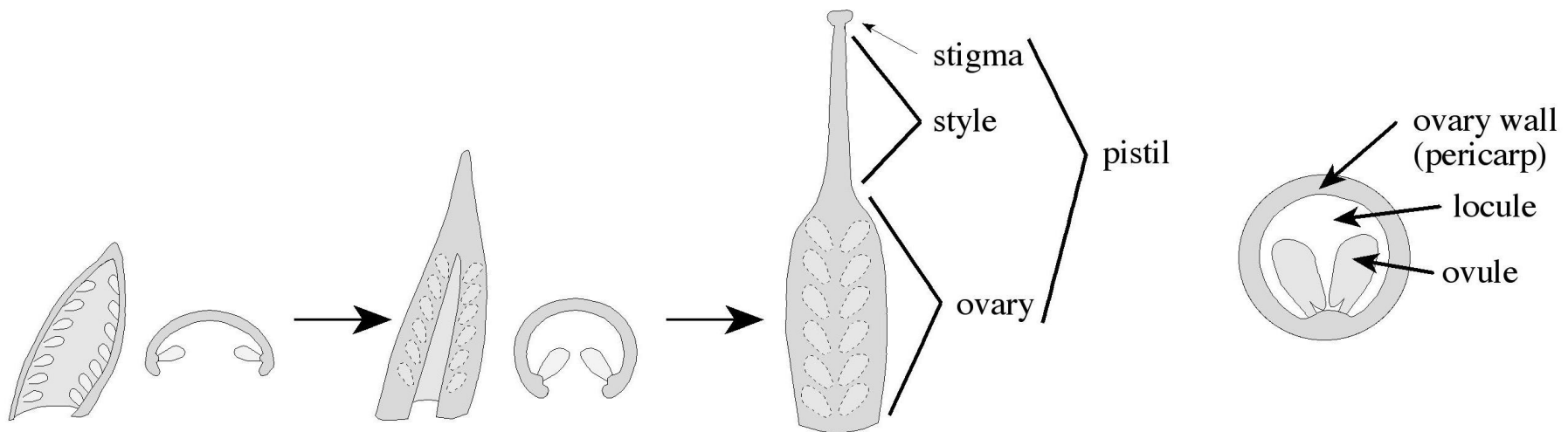
2) Carpels

Carpel = conduplicate megasporophyll

Conduplicate = folded

Megasporophyll = “female leaf, bearing seeds”

Carpel totally encloses ovules/seeds

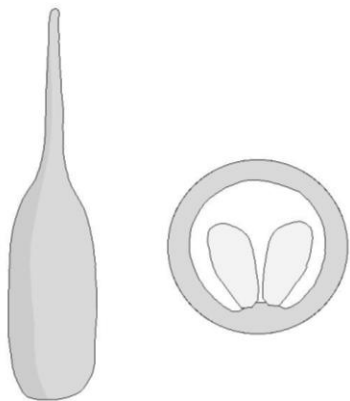


Carpels can fuse together

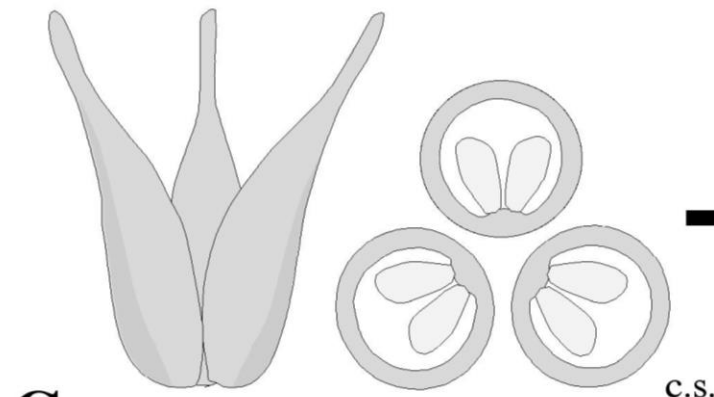
Gynoecium = all female parts

Pistil = ovary + style + stigma

Pistil can be one carpel or many

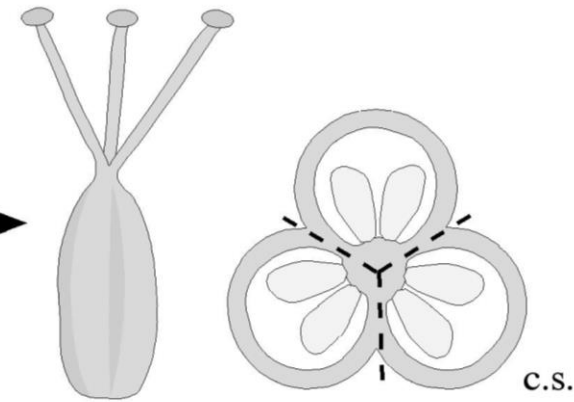


1 pistil, 1 carpel



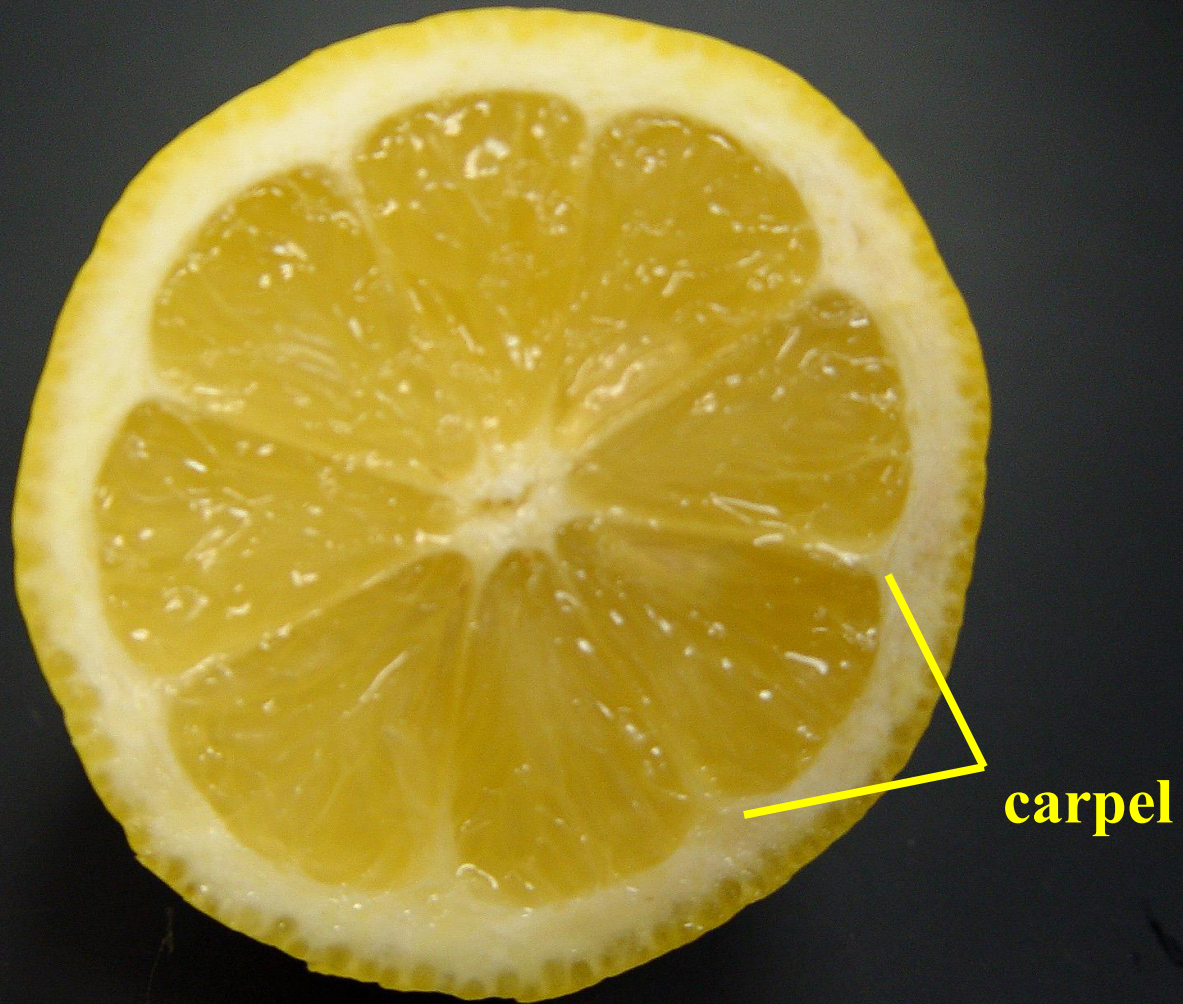
C

3 pistils, 3 carpels



1 pistil, 3 carpels

orange: 8 fused carpels



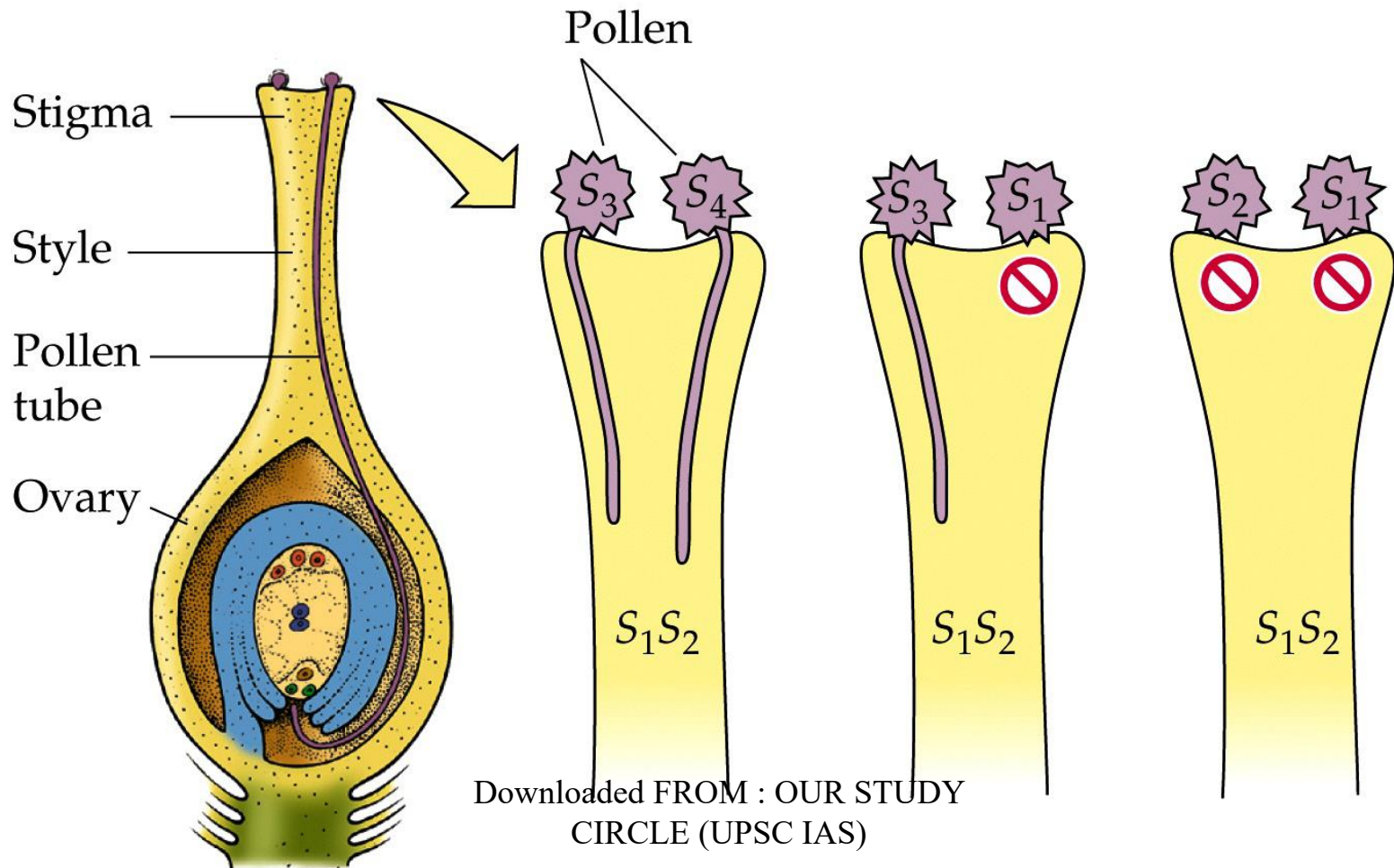
carpel

Function of Carpel

1. Protects young seeds
2. Site of pollen germination
 - Can induce **self-incompatibility reactions**
3. Fruits

Self-incompatibility

- Pollen will not germinate on genetically similar individuals
- Promotes outcrossing



3) Fruits

Fruit = mature ovary
(plus accessory parts)

Function: seed dispersal

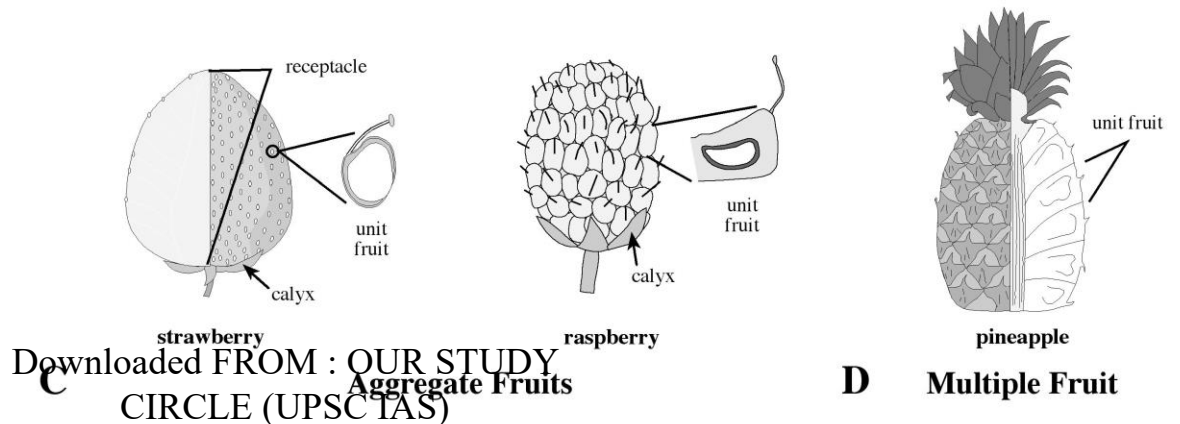
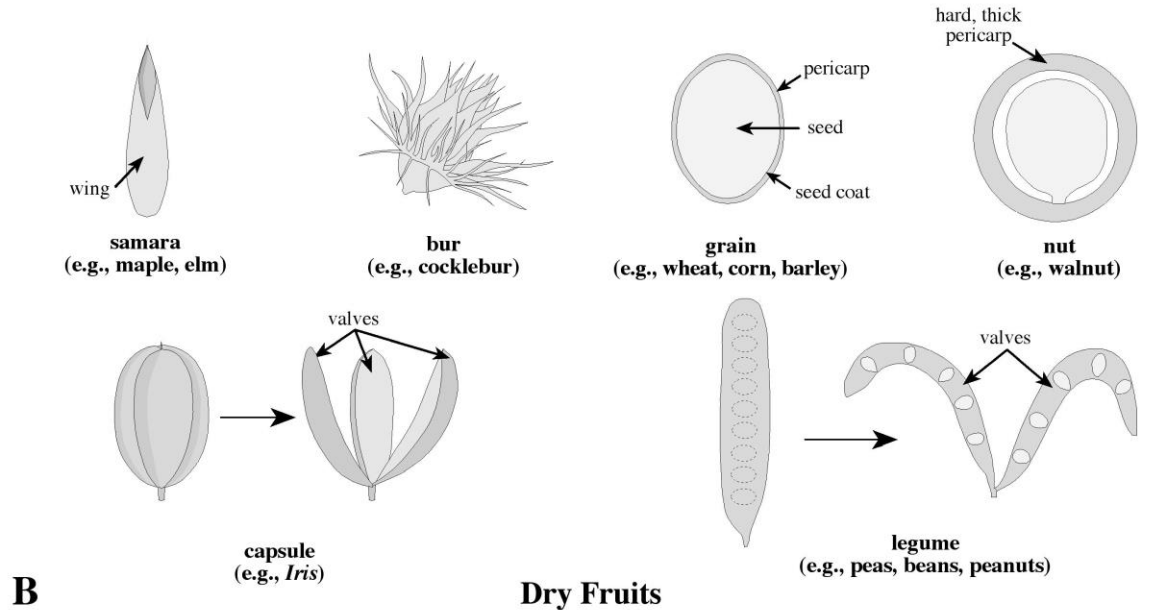
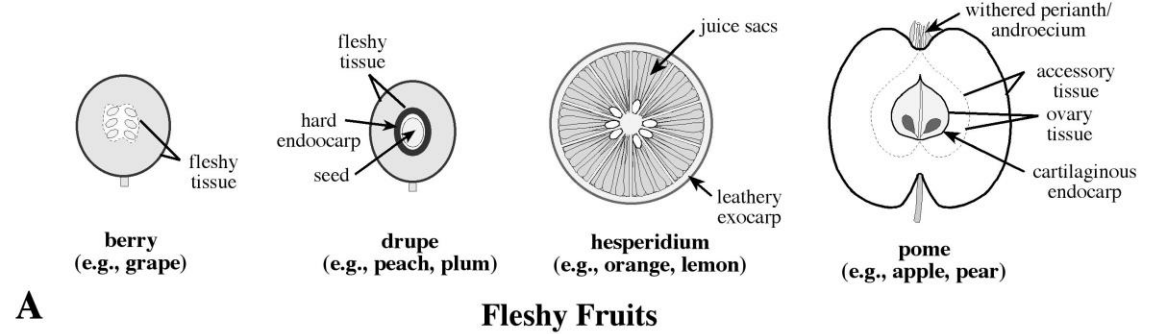
Fruit types:

dry

- dispersed mechanically,
by wind, water,
etc.

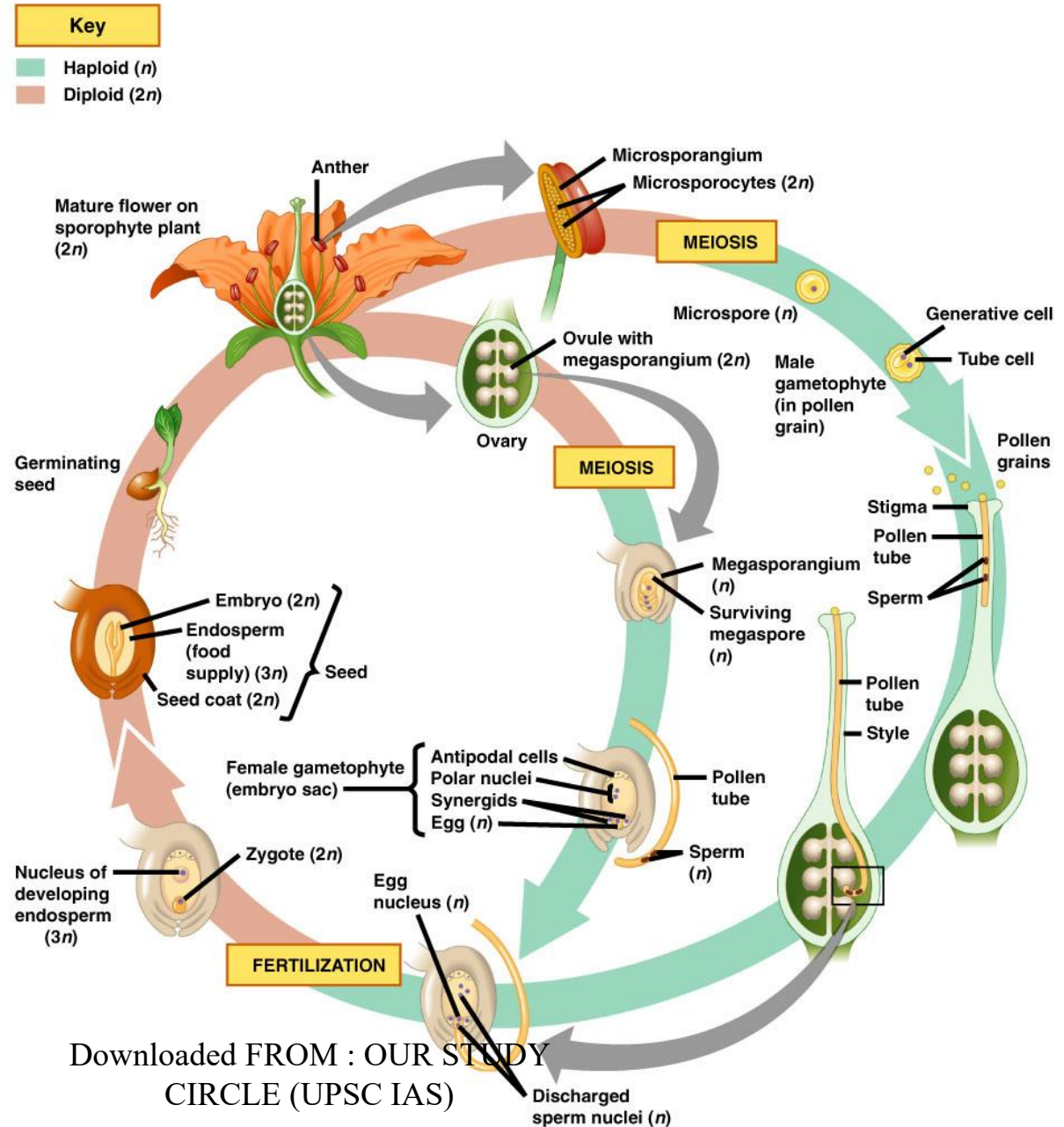
fleshy

- dispersed by
animals



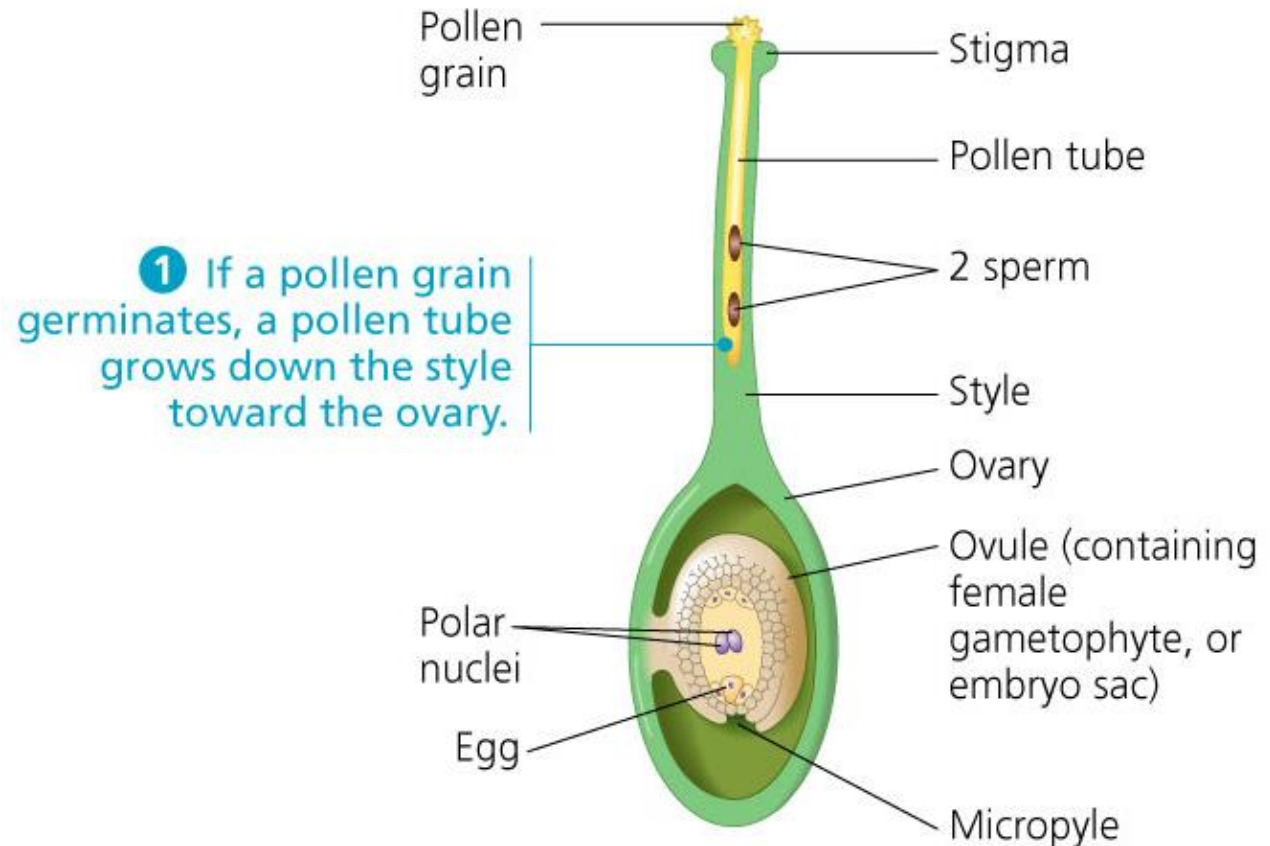
4) Double fertilization in Angiosperms

Assignment:
Study Figs.
38.2, 38.3,
38.5



Double fertilization in Angiosperms

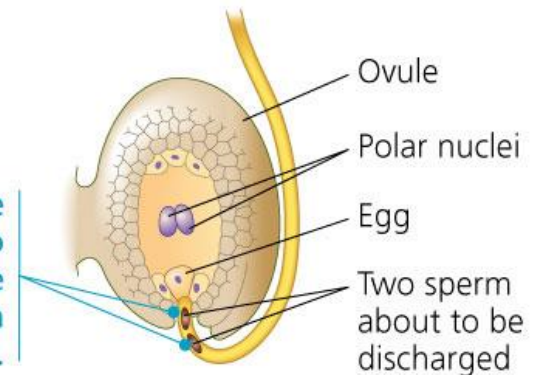
Pollen produces 2 sperm cells:



Double fertilization in Angiosperms

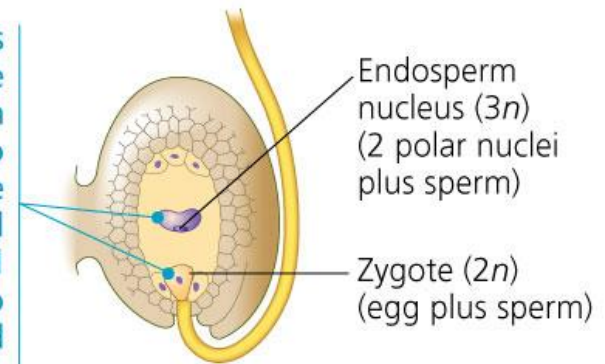
Pollen produces 2 sperm cells:

2 The pollen tube discharges two sperm into the female gametophyte (embryo sac) within an ovule.

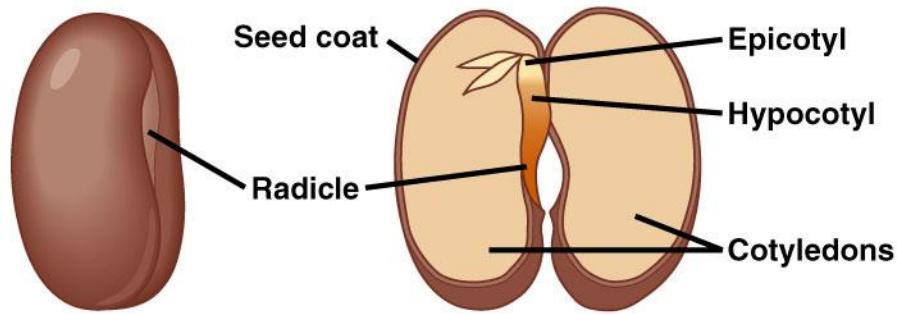


sperm (n) + egg (n)
-----> zygote (2n)

3 One sperm fertilizes the egg, forming the zygote. The other sperm combines with the two polar nuclei of the embryo sac's large central cell, forming a triploid cell that develops into the nutritive tissue called endosperm.

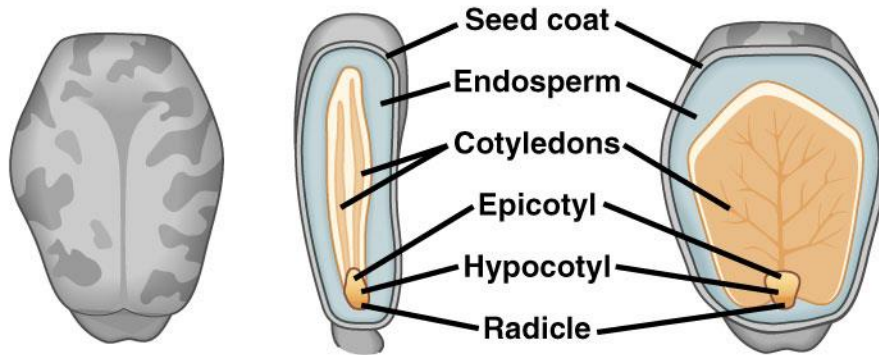


sperm (n) + 2 polar nuclei (n)
-----> endosperm (3n)



(a) Common garden bean, a eudicot with thick cotyledons

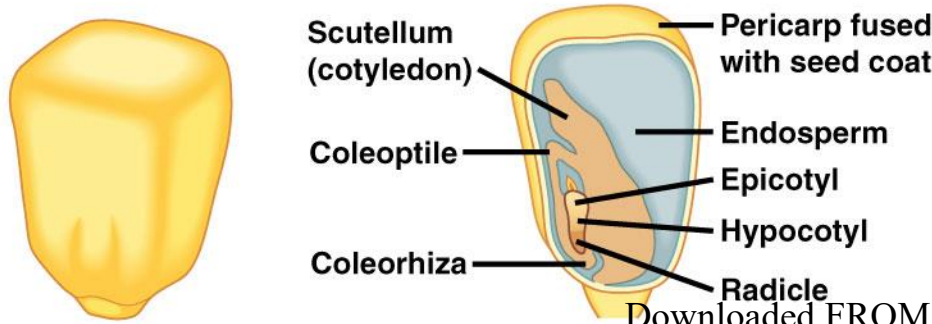
Triploid endosperm is nutritive tissue in seeds of Angiosperms.



(b) Castor bean, a eudicot with thin cotyledons

Extra set of genes may help in:

- 1) rapid development
- 2) increase genetic variation



(c) Maize, a monocot

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Gymnosperms:

- Fertilization occurs long after pollination
- Seeds mature slowly (1-2 years)

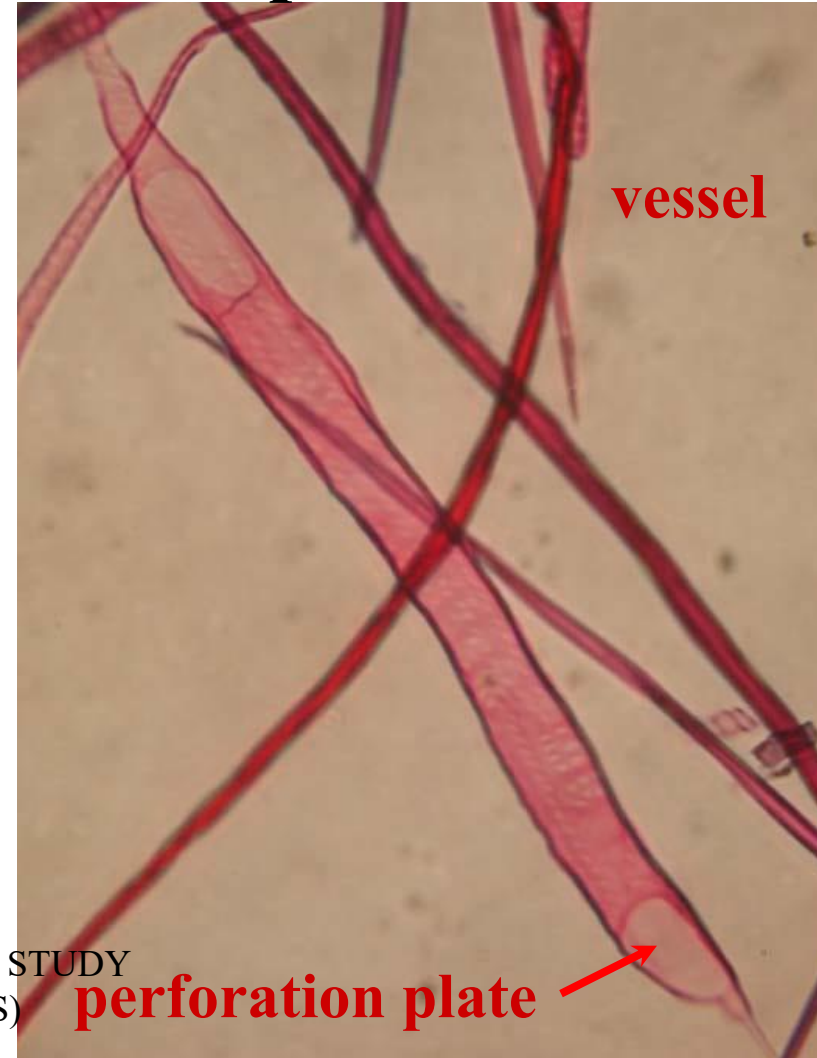
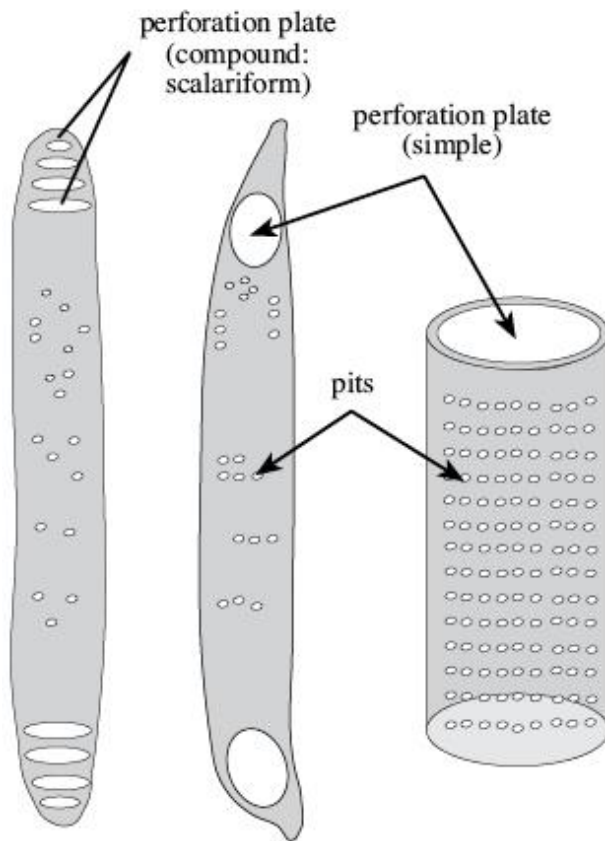
Angiosperms:

- Fertilization occurs soon after pollination
- Seeds produced rapidly
- Selective advantage (e.g., annual herbs)

5) Specialized conductive cells

Most Angiosperms have **vessels**

Specialized in having **perforation plates**

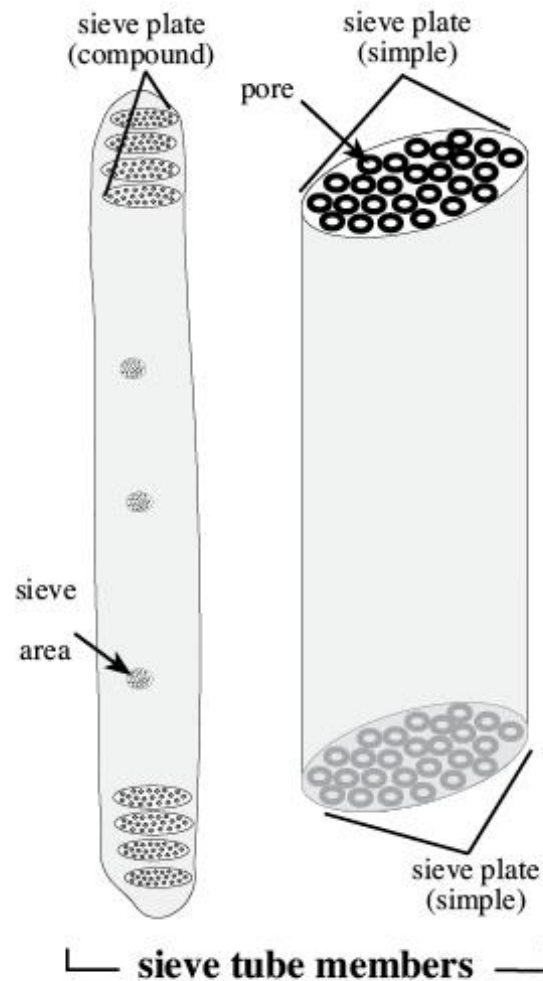


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All Angiosperms have **sieve tube members**

- with **sieve plates**: bigger pores in end walls



big
callose-lined
pores



Angiosperms

Vessels and sieve tube members

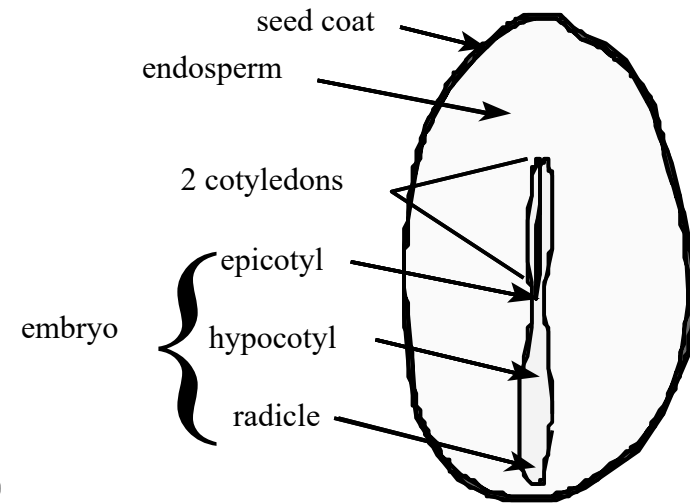
more efficient in water / sugar conduction

Angiosperm Classification

Old classification:

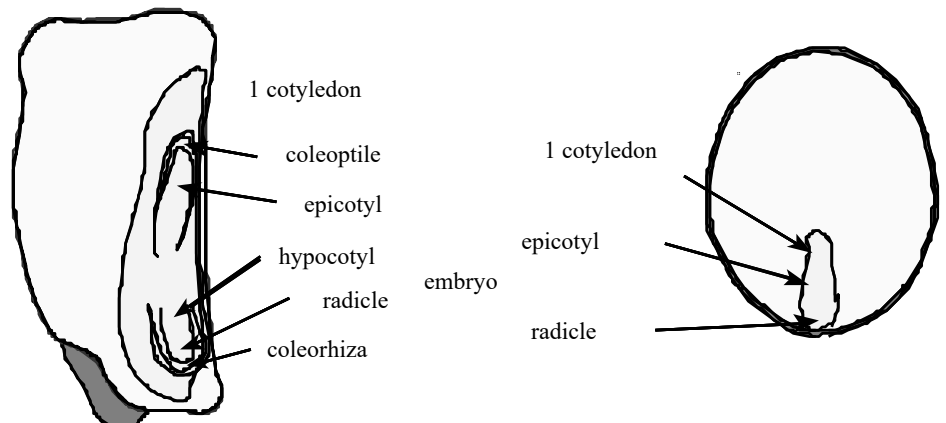
Dicots

- 2 cotyledons (seed leaves)



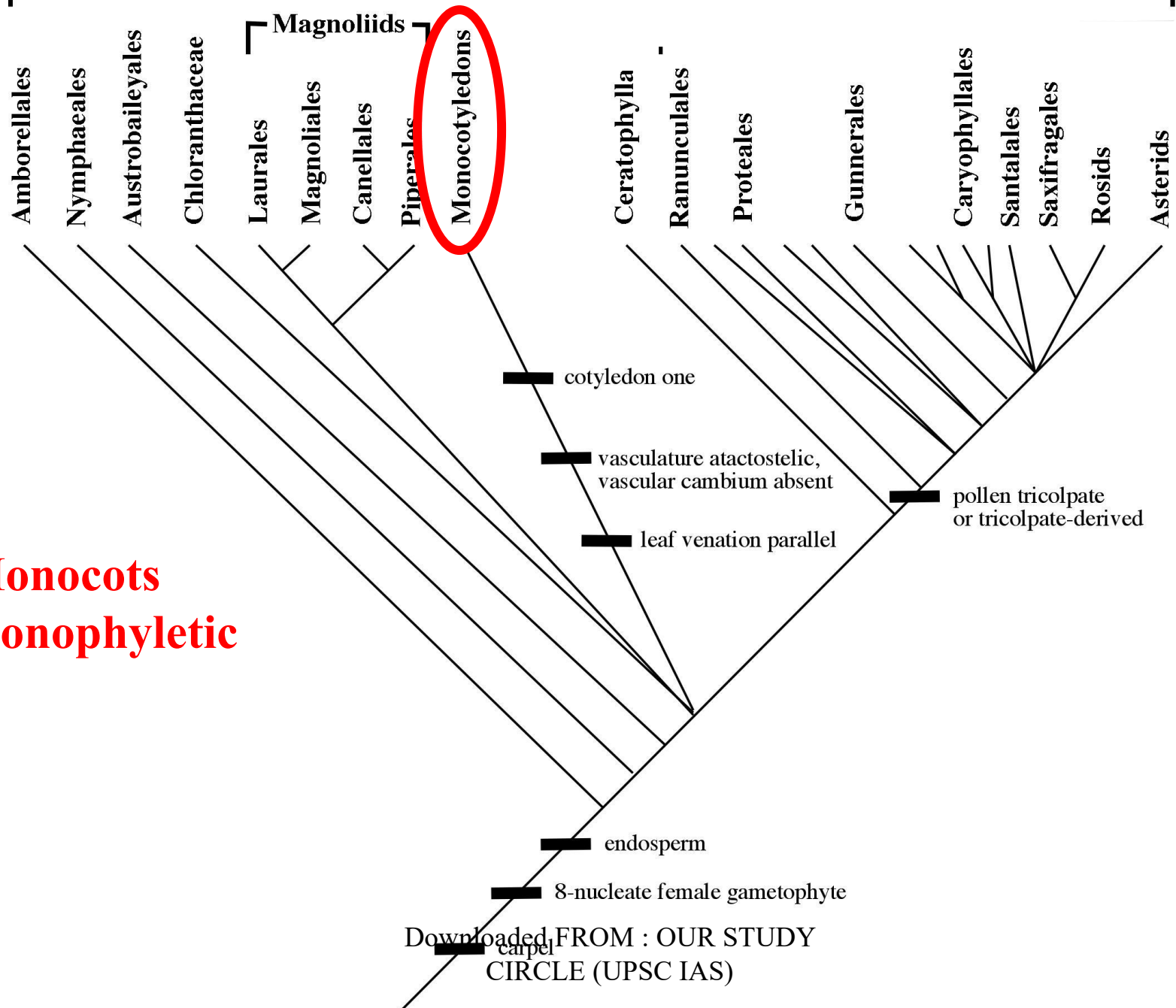
Monocots

- 1 cotyledon



Angiosperms

**Monocots
monophyletic**



Angiosperms

Magnoliids

Eudicots

Amborellales

Nymphaeales

Austrobaileyales

Chloranthaceae

Laurales

Magnoliales

Canellales

Piperales

Monocotyledons

Ceratophyllales

Ranunculales

Proteales

Gunnerales

Caryophyllales

Santalales

Saxifragales

Rosids

Asterids

cotyledon one

vasculature atactostelic,
vascular cambium absent

leaf venation parallel

pollen tricolpate
or tricolpate-derived

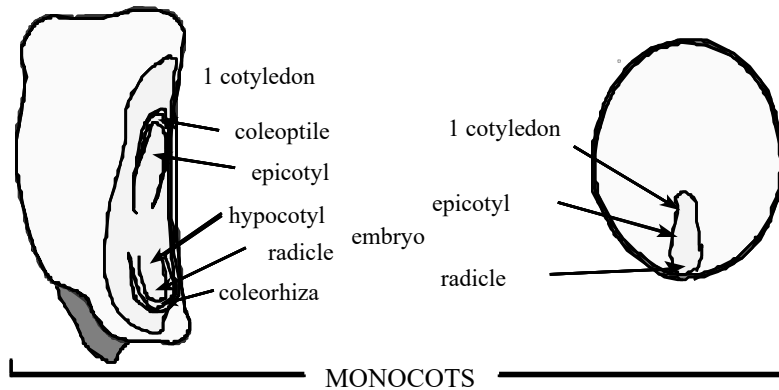
endosperm

8-nucleate female gametophyte

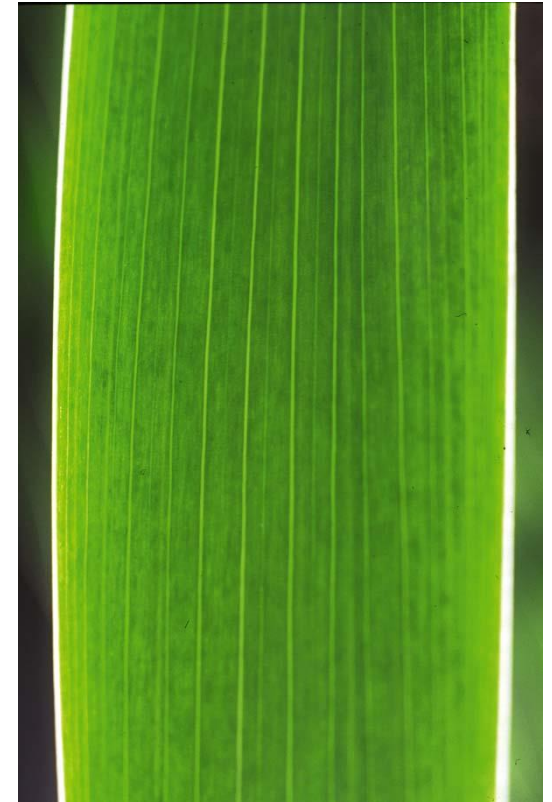
carpel

**Monocot
apomorphies**

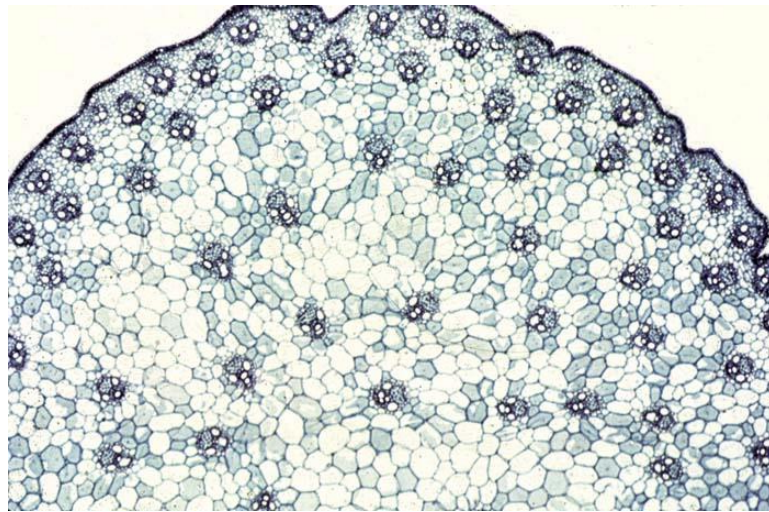
Monocot apomorphies



1 cotyledon



parallel
venation



stem an **atactostele**

-many scattered vascular bundles (wood lost!)

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CELESTIALS

Monocots include:

Palms

Orchids

Irises

Grasses, etc.



Angiosperms

Magnoliids

Amborellales

Nymphaeales

Austrobaileyales

Chloranthaceae

Laurales

Magnoliales

Canellales

Piperales

Monocotyledons

Ceratophylla

Ranunculales

Proteales

Gunnerales

Caryophyllales

Santalales

Saxifragales

Rosids

Asterids

**“Dicots”
paraphyletic!**

cotyledon one

vasculature atactostelic,
vascular cambium absent

leaf venation parallel

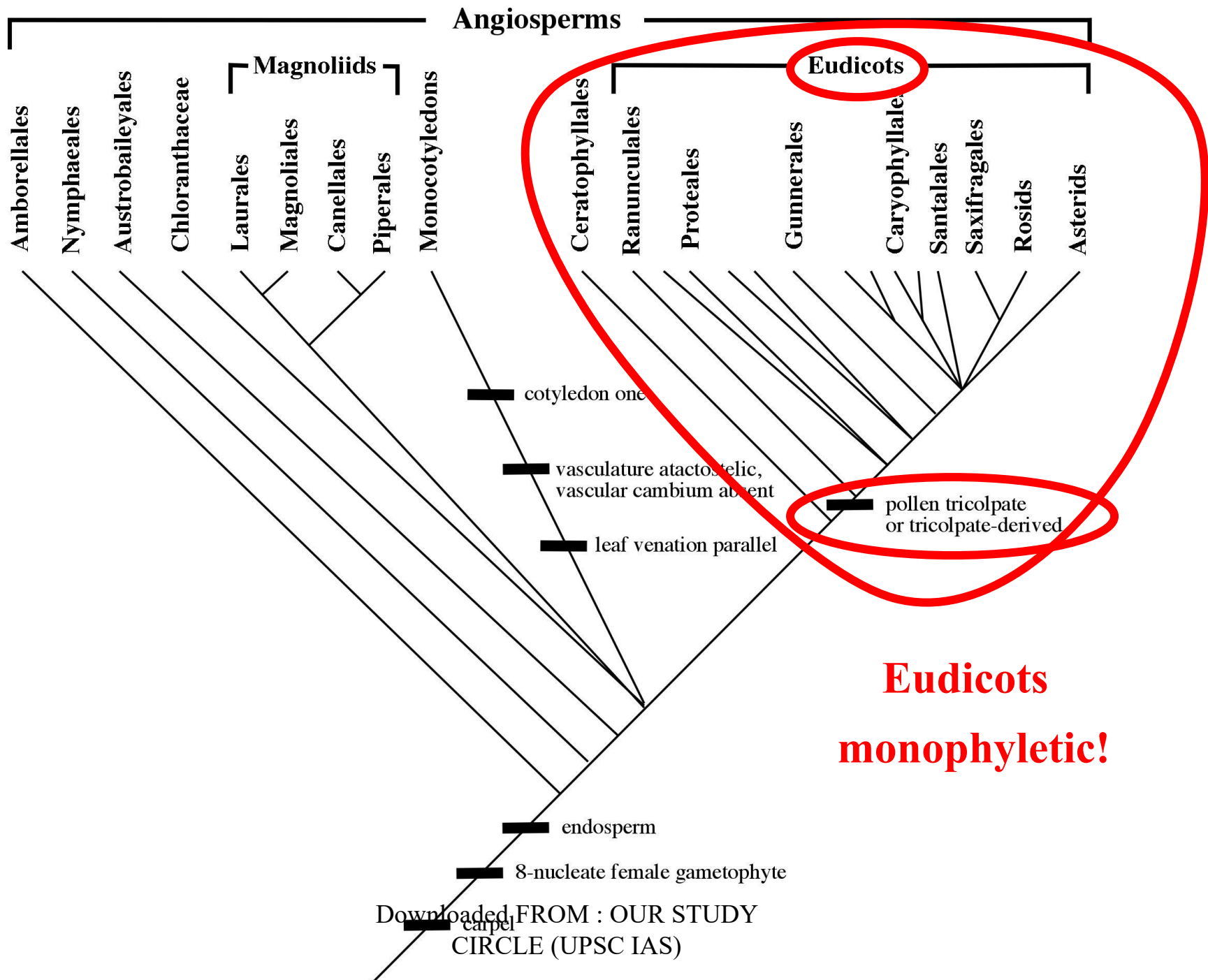
pollen tricolpate
or tricolpate-derived

endosperm

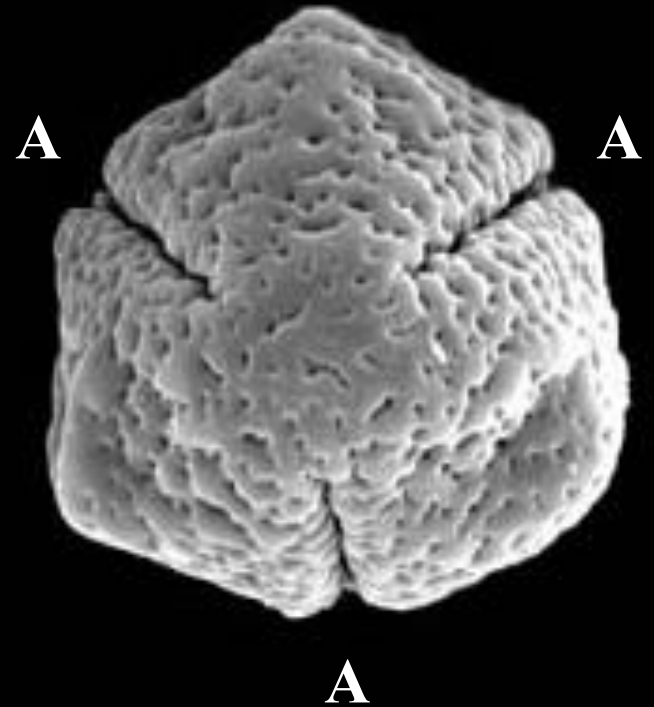
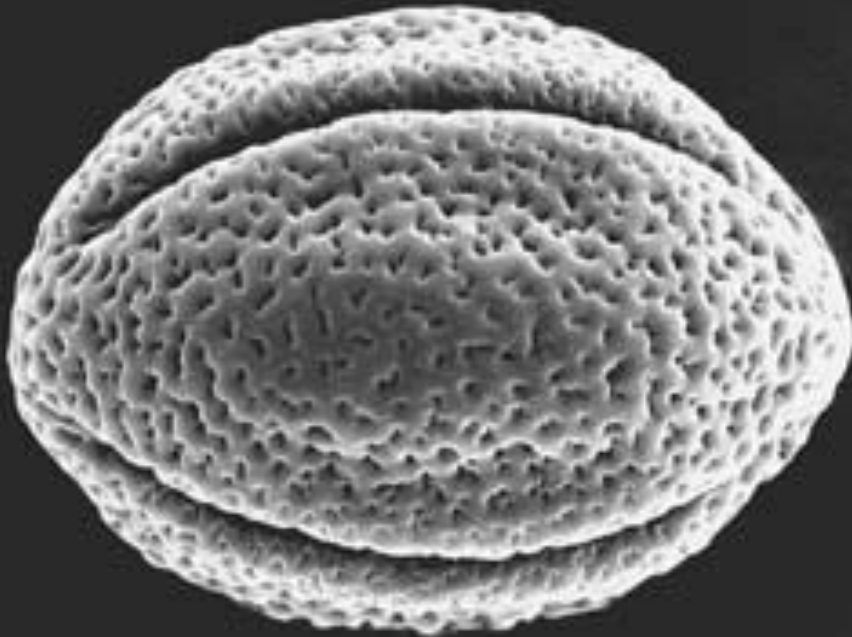
8-nucleate female gametophyte

carpel

Features that defined “Dicots”
are primitive (not apomorphies)



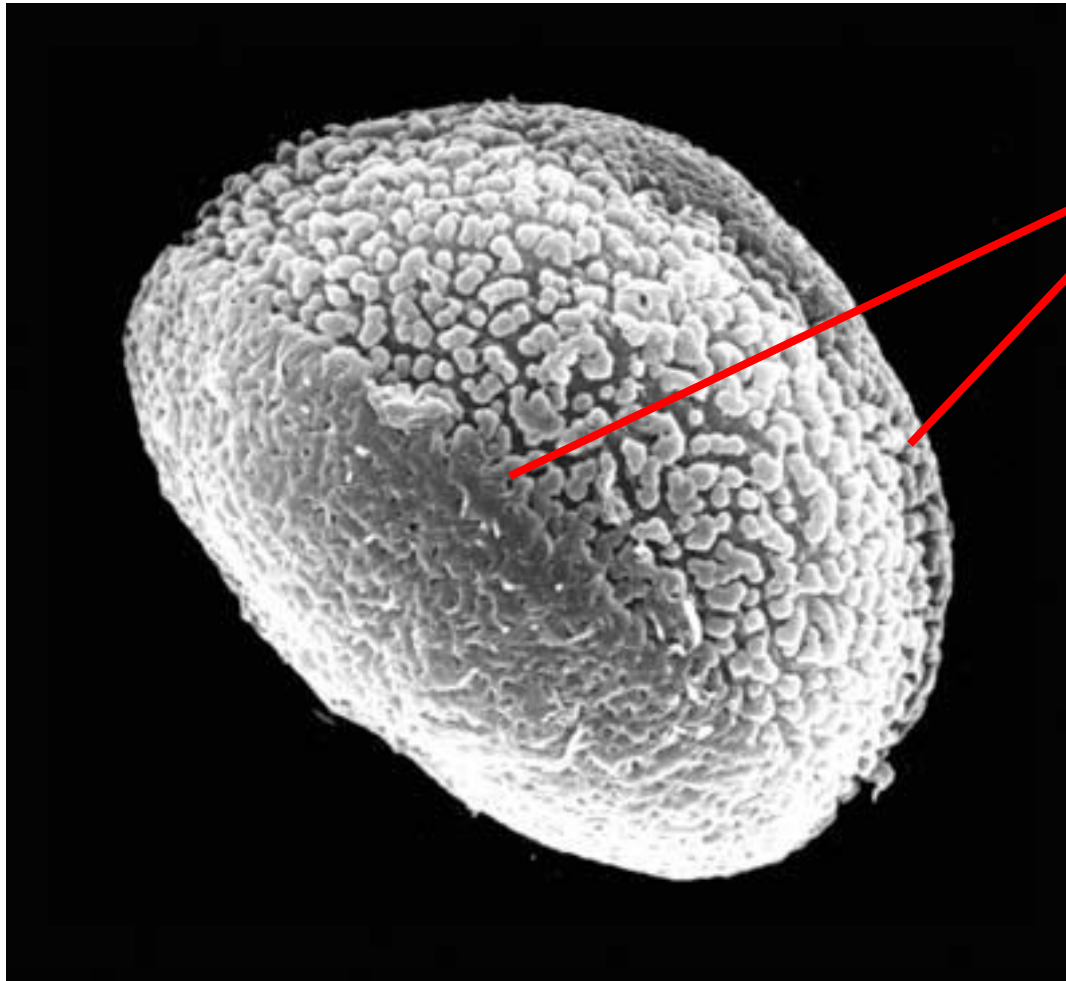
Eudicot apomorphy:



Pollen tricolpate - 3 apertures

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All other Angiosperms:



aperture

Pollen has 1 aperture

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Eudicots include most angiosperms:

Roses

Legumes

Daisies

Oaks, etc.



